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METHOD TO AVOID UNNECESSARY RESOURCE USAGE ON USER PLANE FUNCTIONS FOR USER EQUIPMENT UTILIZING NEW RADIO DUAL CONNECTIVITY

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ABSTRACT

With Third Generation Partnership Project (3GPP) dual connectivity (DC), a multiple receive/transmit (Rx/Tx) capable user equipment (UE) may be configured to utilize resources provided by two different nodes connected via a non-ideal backhaul, with one node providing New Radio (NR) access and the other node providing either Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access (E-UTRA) or NR access. One node may act as a master node (MN) and the node other as the secondary node (SN). The MN and SN are connected via a network interface and at least the MN is connected to the core network. The MN and/or the SN can be operated with shared spectrum channel access. Additional resources can be allocated on a user plane function (UPF) for uplink traffic for a dual connected UE; however, this may lead to a waste of UPF resources in some instances. Presented herein is a technique that provides for the ability to avoid such potential waste of UPF resources without imposing limitations NR-DC sessions.

DETAILED DESCRIPTION

A dual connectivity (DC) user equipment (UE)/handset can obtain access to a mobile core network utilizing a combination of NR (e.g., Fifth Generation (5G)) and E-UTRA (e.g., Fourth Generation (4G)/Long Term Evolution (LTE)) radio resources. Essentially, a DC handset can separately receive LTE and 5G signals and can aggregate the streams. NR dual connectivity uses millimeter Wave and sub-6 Ghz frequencies to achieve multi-GB speed and higher capacities.

Per 3GPP standards, the mobile core network (e.g., Session Management Function (SMF) may decide to allocate additional resources (gtpu tunnel) for uplink traffic for a dual connected UE and send this additional tunnel ID to the master node (MN). Final decision on a Protocol Data Unit (PDU) session split is taken by the MN. If the MN decides to split the PDU session, it initiates a secondary node (SN) addition/modification procedure with the SN. MN/SN may allocate an additional downlink (DL) gtp tunnel ID and is sent back to the SMF. SMF initiates an N4 modification to switch the downlink traffic appropriately.

However, one is issue with this approach is that an additional tunnel (resource) is required on the UPF to support dual connectivity. A few of the Quality of Service (QoS) flows get mapped to one uplink (UL) tunnel and the rest get mapped to additional UL tunnel, as determined by the MN.

An additional DL tunnel allocated by the MN/SN is needed for dual connectivity and subsequent aggregation at the UE. Yet, the additional UL tunnel is not serving any purpose and can unnecessarily lead to a waste of UPF resources. For example, additional tunnel and packet detection rule (PDR) maintenance at the UPF can result in a waste of memory and central processing unit (CPU) usage at the UPF. This can create a significant scalability and/or deployment issues for UPFs when NR-DC operation is enabled.

This proposal provides for the ability to avoid such potential waste of UPF resources without adding any limitations to NR-DC sessions. Figure 1, below, is an example call flow illustrating example details associated with 3GPP standards-based 5G call session establishment for a UE utilizing NR-DC operation. Figures 2A and 2B, below, are an example call flow illustrating example details associated with 3GPP standards-based 5G session establishment involving single NR connectivity in which a subsequent session split is triggered by the MN to support offloading QoS flows from the MN to the SN.

As illustrated in Figures 1, 2A, and 2B, the SMF sends an additional PDR to the UPF requesting the UPF to allocate an additional UPF tunnel ID, also referred to as a Tunnel Endpoint Identifier (TEID), for the split session. However, the solution herein proposes that the same UPF TEID can be used for both tunnels such that both the MN and the SN can utilize the same UPF TEID for the QoS flows handled by each corresponding node. Figure 3, also shown below, is an example call flow illustrating example details associated with 5G call session creation involving an NR-DC UE in which the proposed optimization is utilized through which the same UPF TEID can be used for both tunnels for a split session for the UE. Accordingly, the TEID re-use optimization of this proposal provides for the ability to avoid wasting UPF resources without imposing limitations on NR-DC sessions.

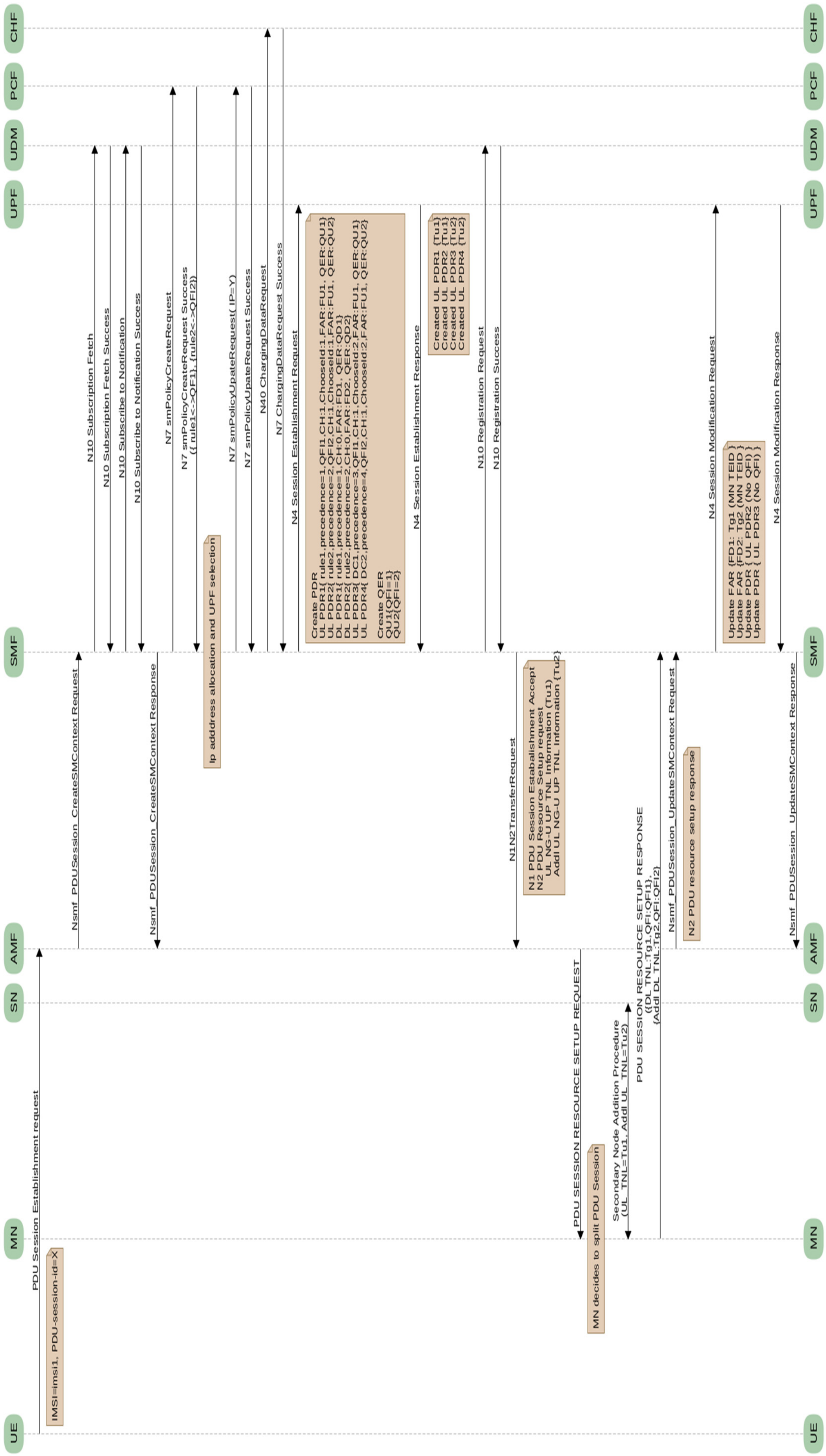

Figure 1: 3GPP Standards-based 5G Session Creation with NR-DC

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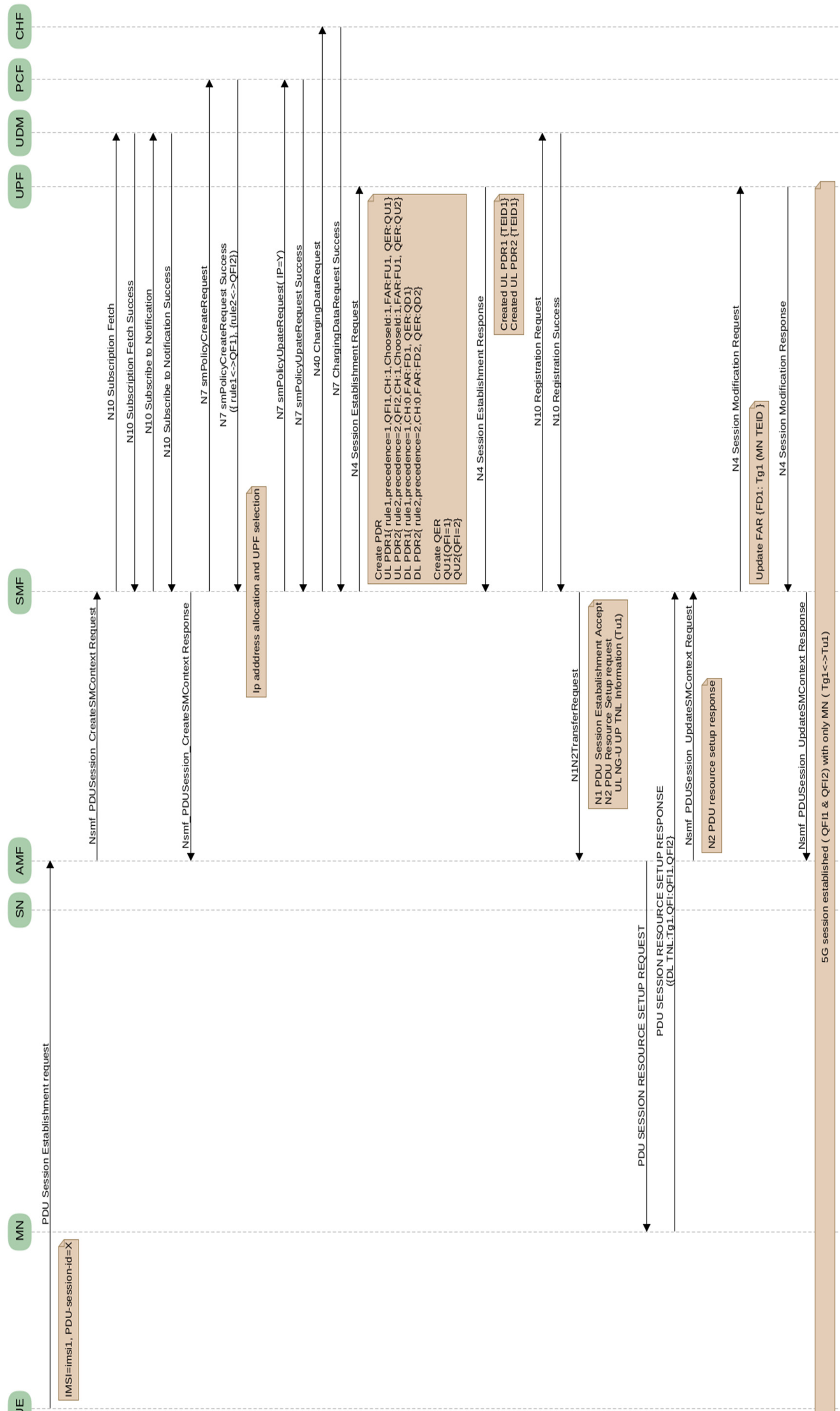

Figure 2A: 3GPP standards-based RAN Initiated QoS Flow Offloading from MN to SN

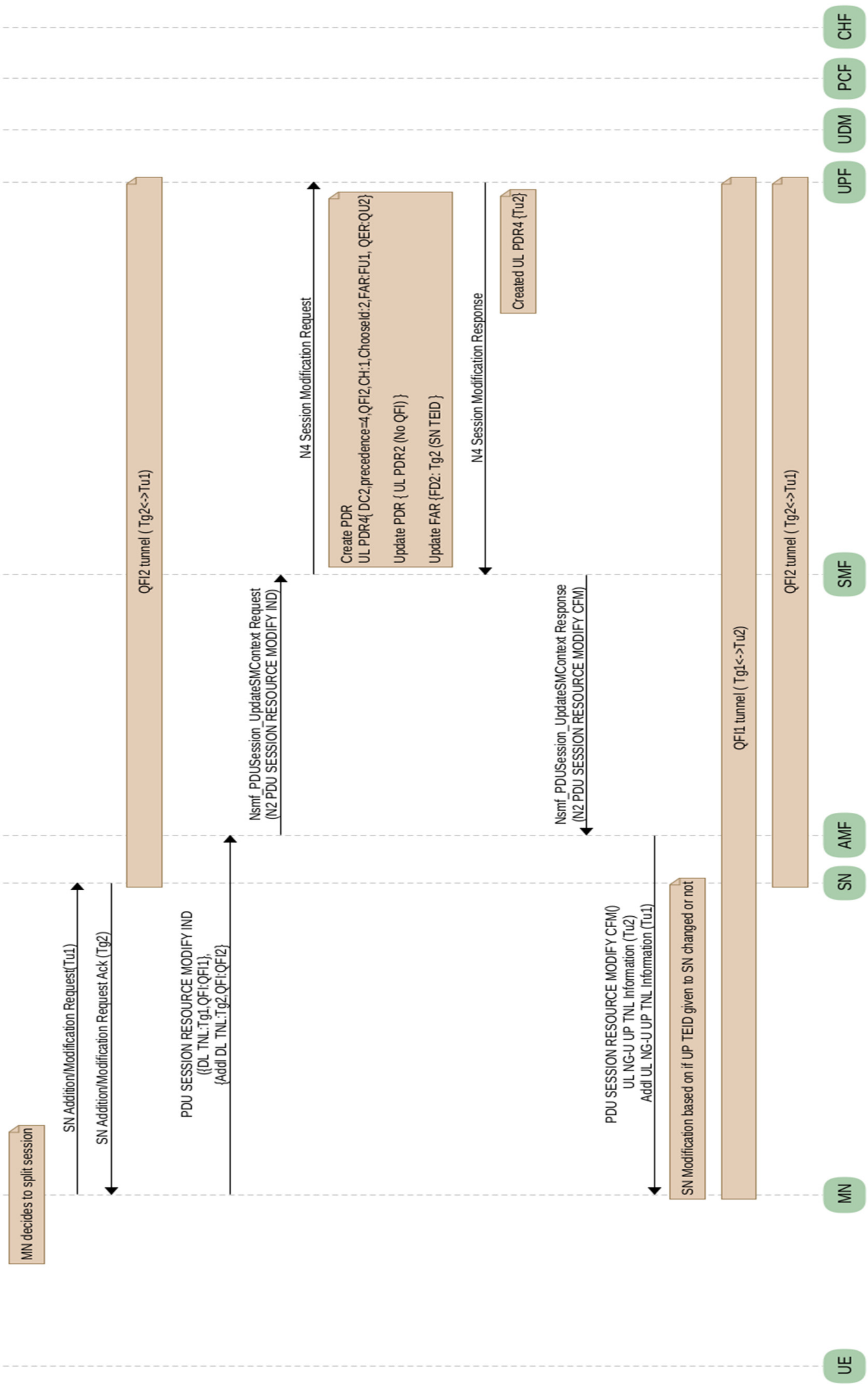

Figure 2B: 3GPP Standards-based RAN Initiated QoS Flow Offloading from MN to SN [Cont.]

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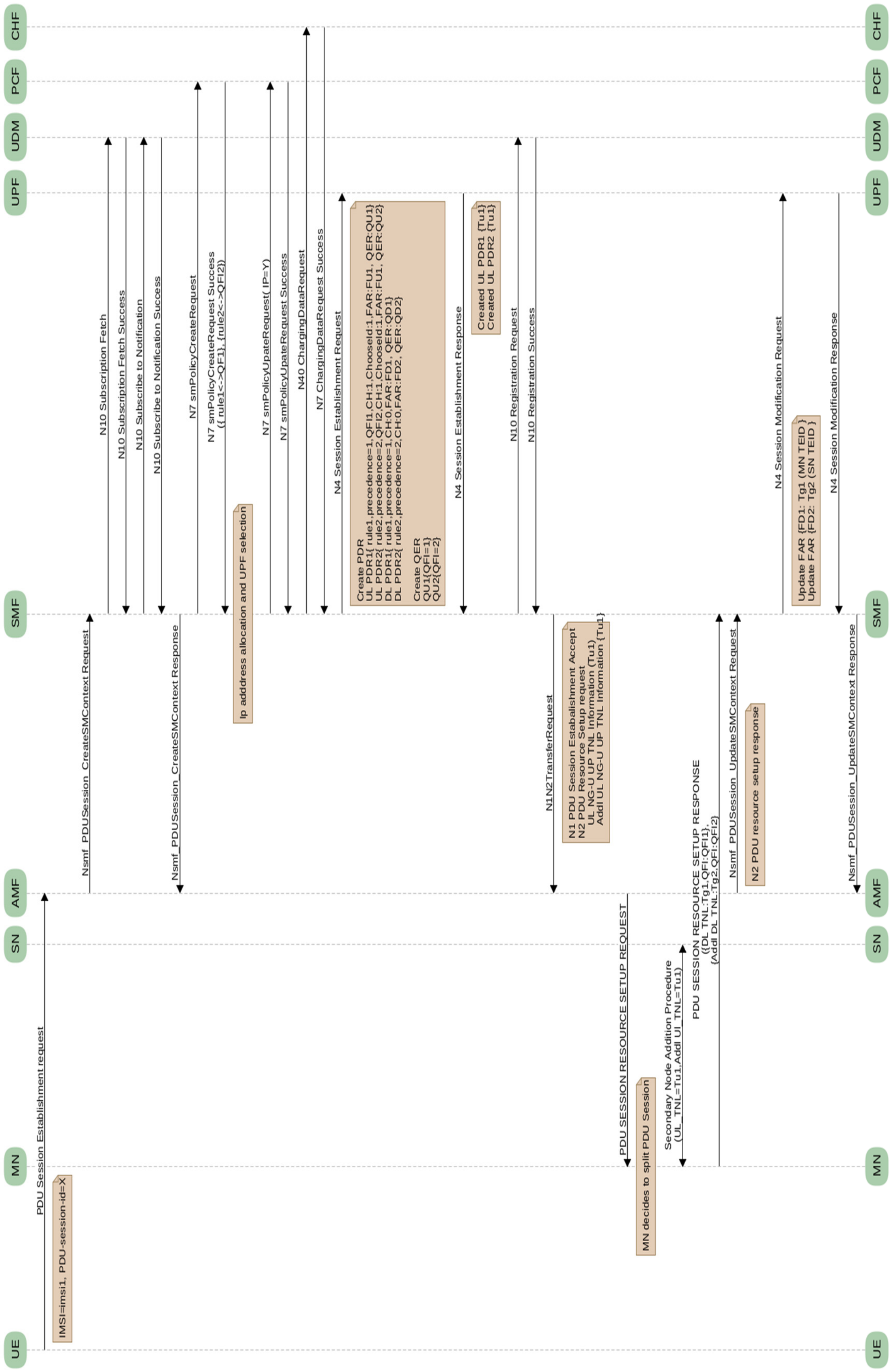

Figure 3: 5G Session Creation with NR-DC Utilizing Proposed Solution

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